IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicants: Jill MacDonald Boyce | Examiner: An, S.

Serial No: 10/529,711 | Group Art Unit: 2621

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For: IMPLICIT WEIGHTING OF REFERENCE PICTURES IN A VIDEO ENCODER

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Hon. Commissioner for Patents
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APPEAL BRIEF

Applicants appeal the status of Claims 1, 3-9, 11, and 13-14 as presented in response to the Office Action dated November 6, 2006, and finally rejected in the final Office Action dated April 10, 2007, the Advisory Action dated May 29, 2007, and the final Office Action dated November 1, 2007, pursuant to the Notice of Appeal filed concurrently herewith and submit this Appeal Brief.

TABLE OF CONTENTS:

1. Real Party in Interest

The real party in interest is THOMSON LICENSING S.A., the assignee of the entire right title and interest in and to the subject application by virtue of an assignment recorded with the Patent Office on March 29, 2005 at reel/frame 016953/0470.

2. Related Appeals and Interferences

None.

3. Status of Claims

Claims 1-14 are pending. Claims 1, 3-9, 11, and 13-14 stand rejected and are under appeal. Claims 2 and (10, and 12) have been objected as being dependent upon rejected base Claims 1 and 9, respectively, but would be allowable: if Claim 2 is rewritten in independent form including all of the limitations of the base claims 1 and any intervening claims; and if either Claim 10 or Claim 12 is rewritten in independent form including all of the limitations of the base Claim 9 and any intervening claims.

A copy of the Claims 1-14 is presented in Section 8 below.

4. Status of Amendments

An amendment under 37 CFR §1.111, mailed to the PTO on January 29, 2007 in response to the non-final Office Action dated November 6, 2006, was entered. A response under 37 C.F.R. §1.116, mailed to the PTO on May 7, 2007 in response to the final Office Action dated April 10, 2007, was considered but deemed to not place the application in condition for

allowance as indicated in an Advisory Action mailed on May 29, 2007. A final Office Action dated November 1, 2007 was issued in response to the previous Appeal Brief filed on July 5, 2007 upon the re-opening of prosecution by the Examiner. No Responses/Amendments, other than the Appeal Brief filed on July 5, 2007, were filed subsequent to the above Response mailed on May 7, 2007.

5. Summary of Claimed Subject Matter

Claim 1 is directed to a video encoder for encoding video signal data for an image block and a plurality of reference picture indices (Claim 1, preamble).

The subject matter of Claim 1, in particular, the encoder is described, e.g., at page 8, line 4 to page 9, line 2, and the reference picture weighting factor assignor, is described, e.g., at: page 8, lines 15-19 and 31-33. Moreover, the subject matter of Claim 1 involves, e.g.: element 500, including element 572, of FIG. 5.

Claim 9 is directed to a method for encoding video signal data for an image block (Claim 9, preamble).

The subject matter of the first step of Claim 9 (starting with "receiving") is described, e.g., at: page 9, lines 6-7. Moreover, the subject matter of the first step of Claim 1 involves, e.g.: element 612 of FIG. 6.

The subject matter of the second step of Claim 9 (starting with "calculating") is described, e.g., at: page 9, lines 12-15. Moreover, the subject matter of the second step of Claim 1 involves, e.g.: element 618 of FIG. 6.

The subject matter of the third step of Claim 9 (starting with "computing") is described,

e.g., at: page 9, lines 17-18. Moreover, the subject matter of the third step of Claim 1 involves, e.g.: element 622 of FIG. 6.

The subject matter of the fourth step of Claim 9 (starting with "motion compensating") is described, e.g., at: page 9, lines 18-20. Moreover, the subject matter of the fourth step of Claim 1 involves, e.g.: element 624 of FIG. 6.

The subject matter of the fifth step of Claim 9 (starting with "multiplying") is described, e.g., at: page 9, lines 21-23. Moreover, the subject matter of the fifth step of Claim 1 involves, e.g.: element 626 of FIG. 6.

The subject matter of the sixth step of Claim 9 (starting with "combining") is described, e.g., at: page 9, lines 26-27. Moreover, the subject matter of the sixth step of Claim 1 involves, e.g.: element 630 of FIG. 6.

The subject matter of the seventh step of Claim 9 (starting with "subtracting") is described, e.g., at: page 9, lines 27-29. Moreover, the subject matter of the seventh step of Claim 1 involves, e.g.: element 632 of FIG. 6.

The subject matter of the eighth step of Claim 9 (starting with "encoding") is described, e.g., at: page 9, lines 30-33. Moreover, the subject matter of the eighth step of Claim 1 involves, e.g.: element 634 of FIG. 6.

6. Grounds of Rejection to be Reviewed on Appeal

Claims 1, 3-9, 11, and 13 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,081,551 to Etoh (hereinafter "Etoh") in view of U.S. Patent No. 4,663,665 to Tanaka et al. (hereinafter "Tanaka"). Moreover, Claim 14 stands rejected under 35 U.S.C.

§103(a) as being unpatentable over Etoh and Tanaka as applied to Claim 9, and further in view of U.S. Patent No. 6,782,054 to Bellers (hereinafter "Bellers"). The preceding rejections are presented for review in this Appeal.

Regarding the grouping of the Claims, Claims 3-8 stand or fall with Claim 1, and Claims 11 and 13-14 stand or fall with Claim 9, due to their respective dependencies. As noted above, Claims 2, 10, and 12 have been objected to, but deemed allowable.

7. Argument

A. Introduction

In general, the present principles are directed to implicit weighting of reference pictures in a video encoder (Applicants' Specification, Title). As disclosed in the Applicants' specification, the present invention is directed to weighting factors, since, "in some video sequences, particularly those with fades, the current picture to be coded or decoded is more strongly correlated with the reference picture scaled by a weighting factor than with the reference picture itself" (Applicant's specification, p. 1, lines 20-22). Moreover, "[w]hen weighting factors are used in encoding, a video encoder needs to determine both the weighting factors and motion vectors" (Applicant's specification, p. 3, lines 3-5).

Accordingly, the present principles provide a novel approach to calculating implicit weighting factors, wherein the distances of the current picture from the reference picture(s) are used to determine the relative weighting factors (Applicant's specification, e.g., p. 5, lines 25-30, and p. 9, lines 10-14).

The claims of the pending invention include novel features not shown in the cited

references and that have already been pointed out to the Examiner.

It is respectfully asserted that Claims 1, 3-9, 11, and 13-14 are patentably distinct and non-obvious over the cited references, as will be shown herein below. As such, Claims 1, 3-9, 11, and 13-14 are presented for review in this appeal.

B. Rejection Under 35 U.S.C. §103(a) Over U.S. Patent No. 6,081,551 in view of U.S. Patent No. 4,663,665

"To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art" (MPEP §2143.03, citing *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)). "If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious" (MPEP §2143.03, citing *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)).

The Examiner rejected Claims 1, 3-9, 11, and 13 as being unpatentable over U.S. Patent No. 6,081,551 to Etoh in view of U.S. Patent No. 4,663,665 to Tanaka et al. The Examiner contends that the combination of Etoh and Tanaka shows all the elements recited in these claims.

Etoh is directed to image coding and decoding apparatus and methods thereof (Etoh, Title). To that end, Etoh discloses, in the Abstract thereof, an apparatus that comprises the following:

> motion detecting means for detecting a motion vector for each block of a prescribed size from a reference image and an input image; weighted motion compensation means for, based on the detected motion vector, extracting from the reference image an area of a prescribed size which is wider than the prescribed

block size and which contains an area corresponding to each block of the input image, and for creating a predicted image for the input image by applying a predetermined weight to each of pixels in the wider area and by using the weighted pixels of the wider area; a predicted-image memory for storing the predicted image; encoding means for taking a residual between the stored predicted image and the input image, and for encoding the residual; and decoding means for decoding the encoded image data and thereby obtaining a reference image.

Tanaka is directed to a TV system conversation apparatus (Tanaka, Title). To that end, Tanaka discloses the following in his Abstract:

The picture quality deterioration such as judder caused by TV frame number conversion can be mitigated by selecting either the stationary original picture signal or the motion-compensated interpolated picture signal based on the most adaptive motion vector corresponding to the smallest interframe difference between the original picture signal and the motion-compensated picture signals based on the motion vectors individually detected from divisional picture areas. The effect of this mitigation can be increased by weighting the detected motion vectors and by smoothing the contour between motion-compensated picture areas with the aid of filtering.

It will be shown herein below that the limitations of the Claims 1 and 9 reproduced herein are not shown in Etoh and/or Tanaka, and that such Claims should be allowed including those dependent therefrom as identified herein.

B1. Claims 1, 3-9, 11, and 13-14

It is respectfully asserted that none of the cited references, either taken singly or in any combination, teach or suggest the following limitations recited in independent Claim 1:

> a reference picture weighting factor assignor responsive to the relative positioning between the image block and first and second reference pictures indicated by the plurality of reference picture indices, the reference picture weighting factor assignor for calculating respective implicit weighting factors for the first and second reference pictures based on respective distances of the image block to the first and second reference pictures.

It is respectfully asserted that none of the cited references, either taken singly or in any combination, teach or suggest the following limitations recited in independent Claim 9:

> calculating implicit weighting factors for the image block responsive to the relative positioning between the image block and first and second reference pictures indicated by first and second reference picture indices based on respective distances of the image block to the first and second reference pictures;

The Examiner has made the following correlations between the above-recited limitations of Claim 1 and Etoh, as set forth at page 2 of the Office Action:

> a reference picture weighting factor assignor (22a, 22b) responsive to the relative positioning between the image block (input image to 22a and 22b via 21a and 21b, respectively) and first and second reference pictures indicated by the plurality of reference picture indices (23, 24), wherein the reference picture weighting factor assignor determines respective implicit weighing factors for the first and second reference pictures (FIG. 5).

The Examiner has made the following correlations between the above-recited limitations of Claim 9 and Etoh, as set forth at page 4 of the Office Action:

> determining implicit weighting factors (22a, 22b, Fig. 5) for the image block responsive to the relative positioning between the image block (Input Image to 22a and 22b via 21a and 21b, respectively) and first and second reference pictures indicated by the plurality of reference picture indices (23, 24)

Nonetheless, in the case of both Claims 1 and 9, the Examiner has admitted that "Etoh does not particularly disclose calculating respective implicit weighting factors for the

first and second reference pictures based on respective distances of the image block to the first and second reference pictures" (Office Action, pp. 3 and 5).

Accordingly, the Examiner has relied upon Tanaka as disclosing the preceding limitations the Examiner has stated are not disclosed in Etoh.

In particular, with respect to both Claims 1 and 9, the Examiner has stated "Tanaka et al teaches TV system conversion apparatus comprising motion vector detecting method, wherein the method comprises calculating respective implicit weighting factors (Fig. 6d-6f) for the first and second reference pictures based on respective distances (Fig. 6d, MV's in Horizontal and Vertical direction) of the image block to the first and second reference pictures for preventing a deterioration in picture quality, thereby obtaining an improvement of picture quality by utilizing the motion-compensated interpolated signal (col. 7, lines 5-66)" (Office Action, pp. 3-4 and 9).

The Applicants respectfully disagree with the Examiner's reading of Tanaka and, further, respectively assert that Tanaka does not even remotely teach or suggest the preceding limitations of Claims 1 and 9.

The Applicants immediately hereinafter reproduce the cited textual sections of Tanaka for the Examiner's convenience.

Column 7, lines 5-56 of Tanaka disclose the following (emphasis added):

> Consequently, in the motion vector detection applicable to the apparatus according to the present invention, the motion vector v" corresponding to the aforesaid smallest interframe difference is not directly obtained from the total sum

of those interframe differences, but is obtained from the product WnXDVn of the above total sum DVn multiplied by a necessary weighting factor Wn.

FIGS. *6(d)* to *6(f)* show various examples of this weighting factor Wn. Particularly, FIG. *6(a)* shows an example in the situation where the comparatively large motion vector in the horizontal direction can be readily detected, as well as the small motion vector and the motion vector in the vertical direction can be hardly detected, so as to be applicable to the situation where it is required to detect the motion vector from the picture portion moving in the horizontal direction at a speed exceeding a certain speed.

FIG. *6(e)* shows another example in the situation where the comparatively large motion vector in the vertical direction can be readily detected, meanwhile FIG. *6(f)* shows still another example in the situation where both a comparatively large motion vectors in the horizontal and the vertical directions can be readily detected.

It is to be noticed that the weighting factor of the motion vector in the direction in which the motion vector can be readily detected in any of those situations as shown in FIGS. *6(d)* to *6(f)* should be small, meanwhile that in the direction in which the motion vector can be hardly detected should be large.

Next, an example of the circuitry including a signal selecting circuit 28 and a minimum value label detecting circuit 29 in FIG. 5, which is preferably

applicable to the apparatus according to the present invention will be described hereinafter.

The improvement of picture quality obtained by the

motion-compensated interpolated picture signal:

It has been described hitherto that the interpolated picture signal required for obtaining the system conversion output picture signal is selected from the linear-interpolated picture signal and the plural motion-compensated interpolated picture signals, in response to the minimum of the absolute values of the interframe differences on the minimum of the total sums multiplied by the weighting factors of those interframe differences. However, when the interpolated picture signal is se-lected as described above only with respect to the sample concerned in the picture, the picture quality deterioration such as so-called judder is occasionally caused, for instance, at the mutual connection contour between the linear-interpolated picture portion and the plural motion-compensated interpolated picture portions or between the plural motion-compensated interpolated picture portions themselves.

Thus, with respect to Figures 6d-f and column 7, lines 5-56 of Tanaka, i.e., the portions of Tanaka cited by the Examiner against the above recited limitations of Claims 1 and 9, Tanaka discloses that the weighting factor of a motion vector is smaller when in the direction in which the motion vector is more easily detected as compared to being larger when in the direction in which the motion vector is more difficult to detect. However, the cited portions of Tanaka do not

even remotely teach or suggest "calculating respective implicit weighting factors for the first and second reference pictures based on respective distances of the image block to the first and second reference pictures" as recited in Claim 1, nor do they even remotely teach or suggest "calculating implicit weighting factors for the image block responsive to the relative positioning between the image block and first and second reference pictures indicated by first and second reference picture indices based on respective distances of the image block to the first and second reference pictures" as recited in Claim 9. For example, DIRECTION as disclosed by Tanaka does not correspond to DISTANCE as recited in Claims 1 and 9. Moreover, neither a DETECTION DIFFICULTY nor a DETECTION ABILITY as disclosed or suggested by Tanaka correspond to DISTANCE as recited in Claims 1 and 9.

Thus, it is clear that the cited sections of Tanaka disclose that the weighting factor assignment is based on direction and a difficultly in detecting a motion vector, and NOT based on respective distances of the image block to the first and second reference pictures as essentially recited in Claims 1 and 9.

Etoh does not cure the deficiencies of Tanaka, and is silent with respect to the above-recited limitations of Claims 1 and 9. For example, as admitted by the Examiner as noted above, "Etoh does not particularly disclose calculating respective implicit weighting factors for the first and second reference pictures based on respective distances of the image block to the first and second reference pictures" (Office Action, p. 3).

Thus, neither Etoh nor Tanaka, either taken singly or in combination, teach or suggest the above-recited limitations of Claims 1 and 9.

Accordingly, Claims 1 and 9 are patentably distinct and non-obvious over the cited references for at least the reasons set forth above. Therefore, withdrawal of the rejection and allowance of Claim 1 (and, thus, also Claims 3-8) and Claim 9 (and, thus, also Claims 11 and 13-14) is earnestly requested.

C. Conclusion

At least the above-identified limitations of the pending claims are not disclosed or suggested by the teachings of Etoh and/or Tanaka. Accordingly, it is respectfully requested that the Board reverse the rejection of Claims 1, 3-9, 11, and 13-14 under 35 U.S.C. §103(a).

Please apply the previously paid Appeal Brief fee of $500.00 from the Appeal Brief filed on July 5, 2007 to cover the fee associated with the filing of this Appeal Brief. It is understood that the current fee due is now $510.00. Therefore, a total of $10.00 is now due for acceptance of this Appeal Brief and the Commissioner is authorized to charge **Thomson Licensing Inc., Deposit Account No. 07-0832** the amount of $10.00 to cover this fee. In the event of any non-payment or improper payment of a required fee, including an improper calculation by Applicant of the increase of any of the Notice of Appeal fee and Appeal Brief fee from the previously filings associated with the Appeal Brief filed on July 5, 2007 with respect to the current filings associated with this Appeal Brief, the Commissioner is authorized to charge **Thomson Licensing Inc., Deposit Account No. 07-0832** as required to correct the error and/or deficiency.

Respectfully submitted,

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8. CLAIMS APPENDIX

1. (previously presented) A video encoder for encoding video signal data for an image block and a plurality of reference picture indices, the encoder comprising a reference picture weighting factor assignor responsive to the relative positioning between the image block and first and second reference pictures indicated by the plurality of reference picture indices, the reference picture weighting factor assignor for calculating respective implicit weighting factors for the first and second reference pictures based on respective distances of the image block to the first and second reference pictures.

2. (previously presented) A video encoder as defined in Claim 1 wherein the reference picture weighting factor assignor comprises:

an interpolation portion for interpolating between portions of two reference pictures disposed one before and one after the image block in display order; and

an extrapolation portion for extrapolating from portions of two reference pictures disposed both before or both after the image block in display order.

3. (previously presented) A video encoder as defined in Claim 1, further comprising a reference picture store in signal communication with the reference picture weighting factor assignor for providing a reference picture corresponding to each reference picture index.

4. (previously presented) A video encoder as defined in Claim 1, further comprising a variable length coder in signal communication with the reference picture weighting factor assignor for encoding the first and second reference picture indices.

5. (previously presented) A video encoder as defined in Claim 1, further comprising a motion compensation unit in signal communication with the reference picture weighting factor assignor for providing motion compensated reference pictures responsive to the reference picture weighting factor assignor.

6. (previously presented) A video encoder as defined in Claim 5, further comprising a multiplier in signal communication with the motion compensation unit and the reference picture weighting factor assignor for applying a weighting factor to a motion compensated reference picture.

7. (previously presented) A video encoder as defined in Claim 6, further comprising prediction means for forming first and second predictors from two different reference pictures.

8. (previously presented) A video encoder as defined in Claim 7 wherein the two different reference pictures are both from the same direction relative to the image block.

9. (previously presented) A method for encoding video signal data for an image block, the method comprising:

receiving a substantially uncompressed image block;

calculating implicit weighting factors for the image block responsive to the relative positioning between the image block and first and second reference pictures indicated by first and second reference picture indices based on respective distances of the image block to the first and second reference pictures;

computing motion vectors for the image block and each of the first and second reference pictures;

motion compensating each of the first and second reference pictures in correspondence with the respective motion vectors;

multiplying each of the motion compensated reference pictures by its calculated implicit weighting factor to form a weighted motion compensated reference picture;

combining each of the weighted motion compensated reference pictures into a combined weighted motion compensated reference picture;

subtracting the combined weighted motion compensated reference picture from the substantially uncompressed image block; and

encoding a signal indicative of the difference between the substantially uncompressed image block and the combined weighted motion compensated reference picture along with the corresponding indices of the first and second reference pictures.

10. (original) A method as defined in Claim 9 wherein calculating an implicit weighting factor comprises at least one of:

interpolating between portions of two reference pictures disposed one before and one after the image block in display order; and

extrapolating from portions of two reference pictures disposed both before or both after the image block in display order.

11. (original) A method as defined in Claim 9 wherein motion compensating each of the retrieved reference pictures comprises determination of motion vectors for the retrieved reference pictures relative to the image block.

12. (original) A method as defined in Claim 9, further comprising:

encoding a picture order count in a slice header field for the image block for use in calculating implicit weighting factors for the image block and the plurality of reference pictures.

13. (original) A method as defined in Claim 9 wherein the relative positioning of the image block and the plurality of reference pictures corresponds to the relative display times of the respective pictures.

14. (previously presented) A method as defined in Claim 9 wherein computing motion vectors comprises:

testing within a search region for every displacement within a pre-determined range of offsets relative to the image block;

calculating at least one of the sum of the absolute difference and the mean squared error of each pixel in the image block with a motion estimated reference picture; and

selecting the offset with the lowest sum of the absolute difference and mean squared error as the motion vector.

9. RELATED EVIDENCE APPENDIX

None.

10. RELATED PROCEEDINGS APPENDIX

None